

DROSOPHILA OF THE ITASCA PARK, MINNESOTA REGION

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Stimulated by the pioneer studies of Sturtevant (1921), Sturtevant and Dobzhansky (1936), and Patterson and his associates (see Patterson and Stone 1952), various investigators recently have made relatively extensive collections of *Drosophila* from divers parts of North America. Thus Spiess (1949) studied New England; Carson and Stalker (1951), Missouri; Spencer (1952), Wyoming; Levitan (1952), southwest Virginia; Stevenson (1952), Tennessee—North Carolina; Williams and Miller (1952), Nebraska; Levitan (1954), New York and New Jersey; and Carpenter and Giordana (1955), Tennessee populations. These studies, plus the extensive investigations of other workers, especially those of Patterson and his students, have established the broad outlines of the distribution of many of the common wild species of *Drosophila* in North America.

Inspection of these records shows, however, a lack of information of the *Drosophila* populations dwelling in the upper Mississippi Valley. Representative of this area is the region about Lake Itasca, Minnesota. During August 1950 and '51, and July and August 1952, collections of the drosophilids of the Itasca State Park region were made along with some ancillary studies on the biology of several of the species. The data derived from these collections and experiments are incomplete and limited but since there appears to be no opportunity within the foreseeable future of adding to them they are herewith presented.

Area Characteristics: Itasca State Park, approximately square in shape, covers about 32,000 acres (49 sq. miles). Contained within its boundaries are numerous ponds and lakes which occupy about 4,000 acres and include Lake Itasca, the headwater lake from which the Mississippi River originates. Except for a limited number of roads, three public camp grounds, State Park Headquarters, a bathing beach, the State Lodge and the University of Minnesota Biological Station, the park is relatively un-

molested. Much of it contains virgin stands of timber. Both the northern coniferous and the southern deciduous hardwood or "Big Tree" forests are represented by "pure" stands. In addition, a typical prairie lies only a few miles to the west of the Park. Consideration of the nature and history of the vegetation and the type of terrain of the Park leads one reasonably to believe that the drosophilid populations now in existence in Itasca Park can give an accurate indication as to what the original populations were like before white man and his techniques seriously disturbed the biota of the region.

Methods: Fifty pound lard cans were used as traps. Rotting, yeasted bananas were placed in the bottom of the cans and served as bait. Two strips of wood (1" × 1" × 16") were laid across the open top of each can and the lid then was rested upon these boards. Thus the flies were able freely to enter or leave the trap, but since the light intensity was much reduced and the humidity considerably elevated within the can, the flies tended to remain within the trap after they had fed. Typically the traps were set upon the ground, but in areas where raccoons (*Procyon lotor*) were abundant it was found necessary to sling the traps in the air about 3 feet above the ground in order to protect the bait. Specimens were collected from the traps in both the morning and evening and most of the trapping was done in the area about the University Biological Station. To insure sampling as many as possible of the various ecological habitats, collections were made in various parts of the Park and also in the surrounding country. The specimens that were found in the traps were captured by means of an insect net and then transported to the laboratory where they were etherized, identified and tabulated. Table 1 indicates the species and number of each taken during the three summers.

OBSERVATIONAL DATA ON THE VARIOUS SPECIES

Drosophila athabasca Sturtevant and Dobzhansky

Drosophila algonquin Sturtevant and Dobzhansky

These two species, both belonging to the same subgroup (affinis) of the obscura species group, were the most abundant drosophilid species collected in the area. *D. athabasca*, however, was consistently 4-5 times as abundant (in the collections) as *D. algonquin*. Adults of both species seemed to range throughout the entire

area for, regardless of where the traps were set, representatives of both were usually present in each collection that was made. If the traps were located in swampy regions, there generally was an increase in the relative number of individuals of *D. algonquin*, especially in areas where there were specimens of maple trees (*Acer rubrum*).

TABLE 1

<i>Drosophila</i>	1950	1951	1952	Total
<i>D. duncani</i>	.....	.....	25	25
<i>D. busckii</i> *	1	.....	1	2
<i>D. algonquin</i>	273	64	343	680
<i>D. athabasca</i>	1092	257	1656	3005
<i>D. melanogaster</i>	17	19	12	48
<i>D. borealis</i> + <i>D. lacicola</i>	256	114	82	452
<i>D. palustris</i>	.....	.....	1	1
<i>D. quinaria</i>	.....	.....	1	1
<i>D. transversa</i>	15	5	83	103
<i>D. testacea</i>	.....	1	23	24
<i>D. funebris</i> *	6	10	29	45
<i>D. macrospina</i>	.....	.....	6	6
<i>D. robusta</i> + <i>D. colorata</i>	82	19	114	215
<i>D. melanica paramelanica</i>	82	36	24	142
<i>D. hydei</i> *	4	.....	1	5
<i>D. repleta</i>*	.....	.....	2	2
Chymomyza				
<i>C. aldrichi</i>	.....	.....	2	2
<i>C. amoena</i>	.....	.....	8	8
Scaptomyza				
<i>S. graminum</i>	2	3	2	7
TOTAL	1748	492	2391	4631
# of collections**	17	7	34	

* = domestic or cosmopolitan species.

** = each collection represents a collection date—for any one collection a number of containers, often scattered over several miles of territory, might be employed.

D. affinis which both Spiess (1949) and Levitan (1955) found associated with *D. algonquin* and *D. athabasca* in the eastern part of the United States was not collected at Lake Itasca although it, as well as the other two species, was abundant at St. Paul, Minnesota, approximately 200 miles south of Itasca.

An intensive but unsuccessful search was made for the habitats of the larvae of these two species. Certain negative evidences should be recorded. The species apparently do not breed in the slime fluxes of the American elm (*Ulmus americana*). Such fluxes were abundant in the region and were inhabited by a number of insect larvae including *D. robusta* and perhaps *D. colorata* as well as numerous individuals of *Aulacogaster* sp.?. Wounds or fluxes on other trees also had no larvae of *algonquin* and *athabasca*, although other insects did dwell in such places. Obviously the microhabitats in which the larvae of these two species dwell must be relatively numerous and uniformly dispersed throughout the area. Since the two species are closely related it can be expected that in nature their larval requirements will be similar but sufficiently different to keep the two species from seriously competing with each other. Carson and Stalker (1951) found *D. athabasca* breeding sporadically in fungi, slime fluxes (red oak, *Quercus borealis*) and rotting fruit (wild persimmons; *Diospyros virginica*) in the vicinity of St. Louis. It is possible that species of the *affinis* subgroup, to which *athabasca* and *algonquin* belong, are opportunistic forest dwellers that utilize any microhabitat that possesses the resources necessary for the production of an adequate flora of microorganisms.

Drosophila borealis Patterson and *D. lacicola* Patterson

These two members of the Montana subgroup of the *virilis* species group were relatively common in the area. Since the adults of both species are extremely similar and can be identified readily only by cytological means or by study of the internal anatomy, especially the female spermatheca, the individuals were not consistently determined to species rank. In every instance where specific identity of a series was made, it was found that *borealis* far outnumbered *lacicola*. Typical was a series of 40 female individuals that Hsu (see Patterson 1952) checked cytologically and in which he found only one specimen of *lacicola* and 39 of *borealis*. The breeding site of these two species, as has been reported previously (Spieth 1951), is in the rotting phloem of various species of aspen. Although the identity of *D. borealis* was known in 1951, the species was not described until 1952 (see Patterson 1952), and therefore all specimens in my 1951 paper were listed as *D. lacicola*, although unquestionably many of them

must have belonged to *D. borealis*. Study of these two species confirmed that (1) the adults normally never leave the immediate vicinity of bodies of water—a characteristic they share with other wild species of the virilis group, (2) they will oviposit freely upon the rotting phloem tissue of various species of aspen, and (3) the larvae normally feed and develop by burrowing in the soft decomposing phloem tissues, apparently feeding upon the microorganisms which are abundant in the woody tissues. Rarely an adult was collected from a trap that was located some distance from a body of water, but in all such instances a gentle but persistent rain had been falling for a considerable period immediately before the collections were made. Apparently when the atmosphere is completely saturated with water vapor, then the adults are no longer rigidly restricted to the immediate vicinity of bodies of water and are able to migrate and thus reach isolated ponds or lakes.

The population density of these species is never great because of the rigidly restricted range of the adults and the exacting requirements of the larvae. Specifically, only in exceptional instances will conditions exist where there is an abundant supply of properly rotting aspen phloem located immediately along the edges of bodies of permanent water. In Itasca Park two such unique situations were found, i.e., (1) in beaver ponds where the animals had felled aspen trees and (2) in a small pond on the campus of the University of Minnesota Biological Station where a number of aspen trees had been felled and cut up into cord wood during a dry period and then subsequently inundated. Similar aspen cord wood located away from the water bodies did not have a population of *lacicola-borealis* larvae even though the condition of the phloem tissues seemed identical with that near the ponds. Apparently the adults will not leave the vicinity of bodies of water in order to oviposit. The rotting phloem does, however, attract the flies if it is located near bodies of water. A piece of bark approximately 2 feet square was peeled from an aspen stump at the edge of the pond mentioned above and numerous adult individuals immediately assembled on the exposed surfaces and remained there throughout the entire day—an extremely atypical behavior since usually the adults are found on the feeding and ovipositioned sites only during the early morning and later afternoon.

Drosophila palustris Spencer, *D. quinaria* Loew, and *D. transversa* Fallen

These three species, all members of the *quinaria* species group, have been reported regularly from the eastern part of the United States. Within the same species group another series of species is distributed in the western U. S., but none of these western species was taken at Itasca. Of the three species only *D. transversa* was common and only one specimen each of *D. quinaria* and *D. palustris* was taken. Carson and Stalker (1951) have confirmed earlier workers in showing that this group is essentially restricted to fungus for breeding sites although some of them can breed in other sorts of materials.

Drosophila testacea van Roser

This fungus feeder, as indicated by Patterson and Stone (1952), is the northern representative of the group and is replaced southwards in the U. S. by the common species *D. putrida*.

Drosophila macrospina Stalker and Spencer

Only two members of the *funnebris* group were collected, i.e., the domestic *D. funnebris* Fab. and the wild *D. macrospina* Stalker and Spencer. The latter was found at only one specific area where six individuals were collected on July 16 and 17, 1952.

Drosophila robusta Sturtevant and *D. colorata* Walker

Both of these species were present in the area but unfortunately the presence of *D. colorata* was not recognized until late in 1952. The specimens have all therefore been lumped together in Table I. Numerous slime fluxes were present in the elm trees (*Ulmus americana*) of the area and specimens of *D. robusta* were bred from these fluxes, thus agreeing with the findings of Carson and Stalker (1951).

Drosophila melanica paramelanica Patterson

Only one species of the *melanica* group *D. m. peremelanica* was found in the Itasca region. Even this subspecies was relatively rare here (143 specimens collected during the three summers) in comparison to the area around St. Paul, Minnesota, where it was one of the most abundant drosophilids of the region.

Chymomyza aldrichi Sturtevant

This species as well as *C. amoena* (Loew) was collected from the bait cans during the summer of 1952. During the previous summer no adult specimens of these species had been found at the bait, but a number of *C. aldrichi* had been reared from larvae and eggs collected in the field. The larvae, as well as pupae of *C. aldrichi*, were first found in the field on July 29, 1951. On July 14, a sharp wind storm had blown down several aspen trees on the University of Minnesota campus area. The heavy bark of these trees had been splintered and on the exposed inner surface (the cambia surface), where the bark was pulled free from the wood or xylem tissue, were found not only various larval stages of *C. aldrichi* but also pupal cases. The larvae and pupae were both taken into the laboratory and adults reared therefrom. Subsequently in 1951 and also 1952, eggs, larvae and pupae of *C. aldrichi* were collected from aspen bark that had been torn loose from the underlying xylem by an agency of one sort or another. A study of the larval habits showed that, unlike larvae of *D. borealis* and *D. lacicola* which bored into the rotting phloem tissue, the larvae of *C. aldrichi* restricted their activities to the inner exposed surface of the bark. Apparently, whenever an accident occurs that results in the exposure of the inner surface of the aspen bark, the females of *C. aldrichi* quickly deposit their eggs upon the surface and when the larvae hatch they feed upon the microorganisms that develop on the moist, somewhat gummy surface. Thus, bark that had been injured on July 14, 1951, had by July 29 produced mature pupae. *D. aldrichi* larvae appear to be one of the first macroscopic invaders of such wounded places on the aspen and perhaps other trees and, because of the relative time of their invasions and their habits of feeding upon the surface of the food, they are out of competition with the forms that burrow in the bark. Wheeler (1952) found the adults on peeled areas of trees, mainly aspen, fir and pine.

DISCUSSION

Excluding the cosmopolitan species such as *melanogaster*, *buseckii*, *hydei*, *repleta* and *funnebris*, only 13 species of wild drosophilids were collected in the Lake Itasca area during the

three summers of 1950, '51, and '52. Most of these 13 species range throughout the deciduous forest areas of northeastern North America, but are not found in the western part of the continent. Thus, of the 13 species, only *D. borealis* and the wide-ranging *D. athabasca* are found in the western part of the country. Therefore the drosophilid fauna of the area is essentially eastern in character.

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